375

TM 7557A

50 Mc/s Range Unit

INSTRUCTION MANUAL

MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

MP MASTER
MA23714

375

Instruction Manual

No. EBM 7557A

for

50 Mc/s Range Unit

TM 7557A

M.I. Technical Publications

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MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

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Section 1

General information

1.1 INTRODUCTION

The 50 Mc/s Range Unit, TM 7557A is a plug-in unit designed for operation with the TF 2401A Counter and a Function Unit. With this unit fitted, the Counter operates to 50 Mc/s.

The Range Unit contains the 'A' input amplifier, gate control circuitry and the high speed decade counting unit.

Fig. 1.1 50 Mc/s Range Unit TM 7557A

1.2 DATA SUMMARY

INPUT :	Single channel (A).
RANGE :	1 c/s to 50 Mc/s.
SENSITIVITY :	0.1 V r.m.s., 5 c/s to 50 Mc/s; reduced sensitivity below 5 c/s.
ATTENUATOR :	Factors of 1, 4, 16, 64 and 256, switch selected.
INPUT IMPEDANCE :	Approximately 350 kΩ shunted by 25 pF.
MAX. INPUT LEVEL :	500 V p-p on X256 attenuator setting. 3 V r.m.s. on X1 attenuator setting.
SLOPE SELECTION :	Positive or negative.
GATE TIMES :	As for basic counter.
ACCURACY :	±1 count ± time base accuracy.
ACCESSORIES SUPPLIED :	1 x BNC free plug. Printed board jacking screw; TM 7837. To facilitate removal of printed boards.

Section 2

Operation

2.1 INSTALLATION

The space in the basic Counter, provided to accept the Range unit is shown on the illustration in the TF 2401A manual. The unit is easily installed by locating it in its guide channel, and pushing it slowly to the rear of the Counter until it locks with its mating connectors. Once firmly in position secure the unit using the locking screw provided at the bottom of the front panel.

2.2 CONTROLS AND CONNECTORS

① ATTENUATOR switch. Selects the attenuation factor applied to the input signal.

② TRIGGER LEVEL control. Determines the instantaneous voltage of the direct or attenuated input signal which will trigger the input amplifier.

③ SLOPE switch. Determines which slope (positive or negative) of the input signal will trigger the input amplifier.

④ A Input connector. BNC socket for 'A' Input signal.

2.3 CONNECTING INPUTS

The input connection should normally be shielded, by the use of coaxial cable, to prevent noise pick-up.

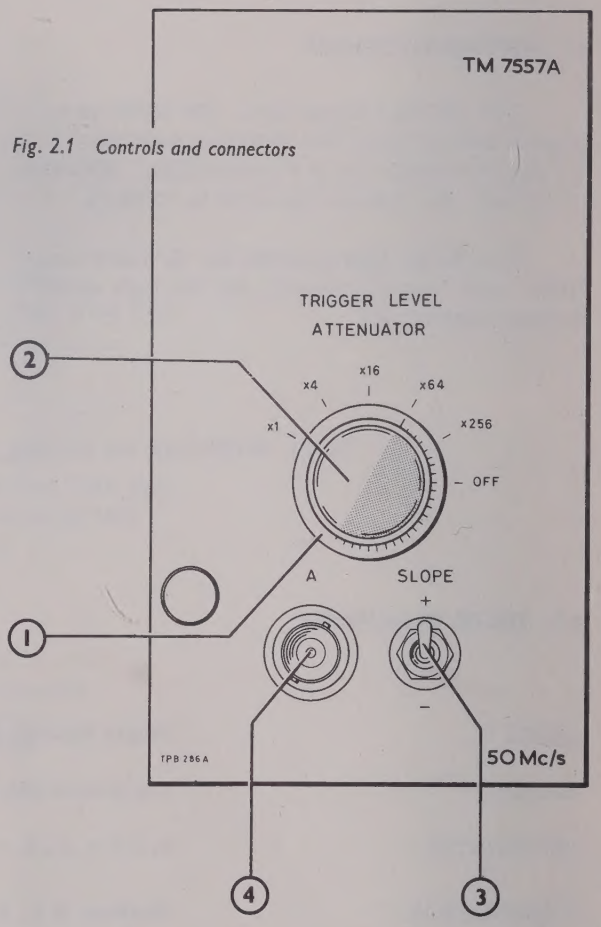


Fig. 2.1 Controls and connectors

2.4 OPERATING PROCEDURE

Refer to the appropriate Function Unit manual for the operating procedure.

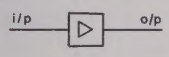
Section 3

Logic description

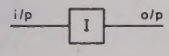
3.1 LOGIC DEFINITIONS

Logic diagrams are used in the manual to help give an understanding of the operation of the circuits, and show how the elements are functionally interconnected.

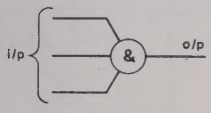
Fig. 3.1 shows the logic symbols which are used in the descriptions of the various circuits. For further details see section 3.1 of the manual for Counter TF 2401A.



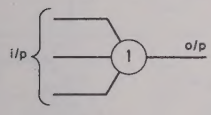
amplifier



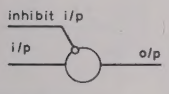
inverter — changes phase of input signal.



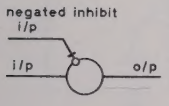
AND gate — all inputs must be in the '1' state (i.e., active) for the output to be in the '1' state.



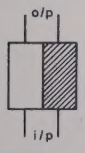
OR gate — one or more input in the '1' state will give a '1' state output.



inhibit gate — the inhibit input in the '1' state prevents a '1' state output no matter what the other input's state.



negated inhibit gate — the negated inhibit input must be in the '1' state to obtain a '1' state output.



bistable — a momentary signal on one input will set the corresponding output to the '1' state, where it will remain until a signal is applied to the other input.

Fig. 3.1 Logic symbols

3.2 TM 7607: 50 Mc/s INPUT AMPLIFIER

TM 7607, driven by the impedance buffer mounted behind the front panel, carries the high frequency channel 'A' amplifier and the necessary gating and signal routing to provide a count signal for the main Counter gate in the gate control and count gate unit.

The 'A' signal passes through a phase splitter to provide two antiphase signals required for

slope selection gating. Depending on which slope is desired for triggering, one of the AND gates is opened by either the 'A' amplifier select signal or the period 'A' select signal, via the SLOPE switch.

The outputs from the two slope selection gates, and the selected auxiliary input signal are fed through an OR gate into the level detector. The triggering point of the level detector is determined by the TRIGGER LEVEL control; this control is operative only when an 'A' amplifier select or a period 'A' select signal is available to couple +6 V to the top end of the TRIGGER LEVEL potentiometer.

The output from the level detector is gated with the 'A' amplifier select signal, the presence of which allows the signal to pass to the output to drive the main counter gate. The main gate is alternatively driven by the time interval measurement (T.I.M.) signal or the time base output signal.

A period 'A' facility is incorporated so that if the correct Function unit is used, a period 'A' select signal will be provided to allow the output from the level detector to pass into the 'B' input channel of the gate control and count gate unit, TM 7605. This signal would be used as a control signal for the main counter gate.

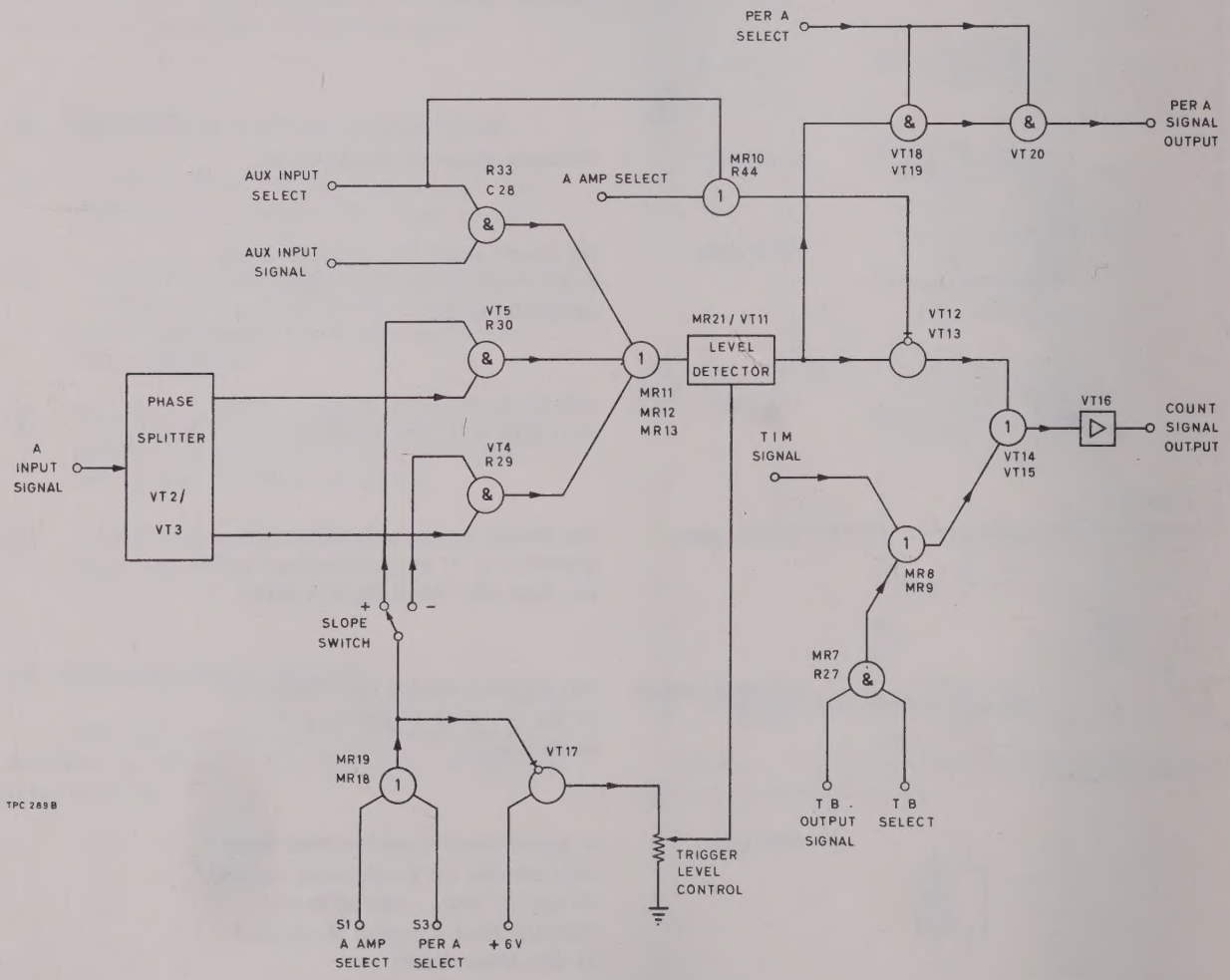


Fig. 3.2 Logic diagram for 50 Mc/s input amplifier

3.3 TM 7605: GATE CONTROL and COUNT GATE UNIT

This unit comprises the main counter gate and the necessary logic gating to select signals to control the opening and closing of this gate.

Fig. 3.3 shows the logic diagram for this unit. The four conditions of drive are :

1. Time base outputs to start and stop the count.
2. 'B' input signal to start and stop the count.
3. 'B' input signal to start and 'C' input signal to stop the count.
4. Manual starting and stopping of the count.

The start signal is derived from a time base output, the 'B' amplifier output or manually applied by the GATE switch. The time base signal is gated with the time base start-stop select signal, S4, and the 'B' amplifier signal is gated with the 'B' start select signal, S5; S5 also inhibits the selection of the time base signal. The selected signal is passed through OR gate MR14, MR13, to the trigger MR12, VT14.

From the trigger, the signal is taken via an inhibit gate to drive the start bistable trigger circuit. The drive is inhibited by the reset signal so that the circuit has reset before another drive signal passes to the bistable.

The output from the bistable is taken through an OR gate to open the main counter gate, which can now pass the count signal to the counting decades and readout. The main counter gate is inhibited with the output signal from the stop bistable, but this inhibiting cannot take place until the start bistable has been reset, and set again by a start signal.

Selection and routing of the stop signal is similar to that of the start signal. In this case the signal is derived from the 'B' amplifier output, the 'C' amplifier output, or a time base output, this latter signal being the same one that provides a start signal.

The stop bistable circuit is inhibited until the start bistable has been turned on. Manual stop inhibit is generated by the front panel GATE switch.

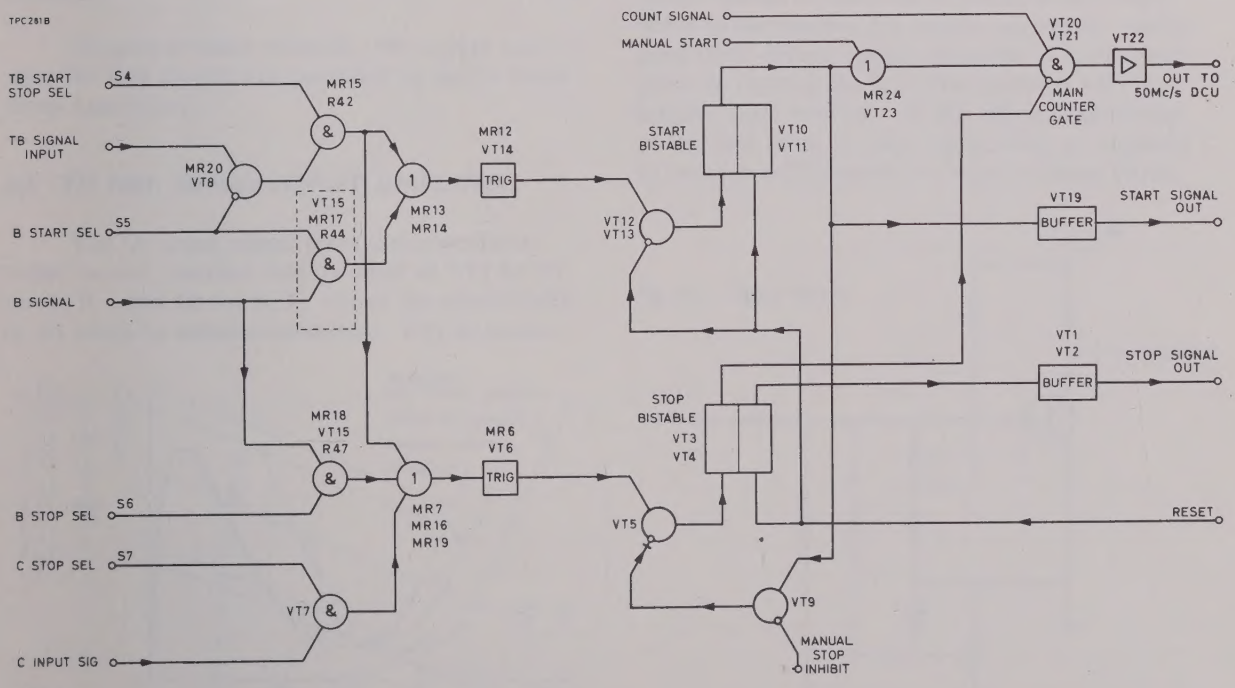


Fig. 3.3 Logic diagram for gate control and count gate unit

3.4 TM 7608: 10 Mc/s MULTIPLIER

The 1 Mc/s signal is fed to an AND gate (VT7) and also multiplied and fed to another AND gate (MR4, R19). The CLOCK FREQ switch provides the select signal J1 or J2 to open one of these gates; the resulting 1 Mc/s or 10 Mc/s signal is then passed through an OR gate and amplifier to the output as the T. I. M. (time interval measurement) signal.

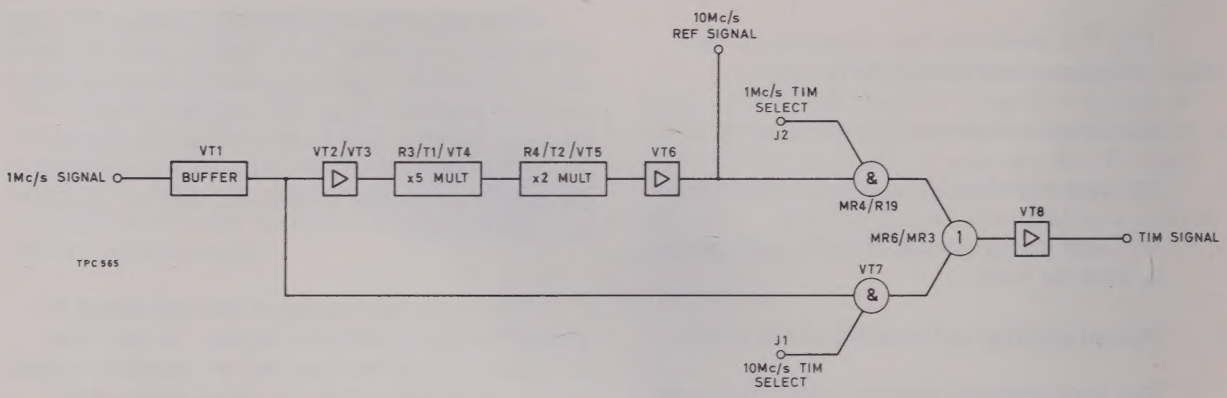


Fig. 3.4 10 Mc/s multiplier and T.I.M. selection gates

Section 4

Technical description

4.1 TM 7646: IMPEDANCE BUFFER

This circuit forms a low gain, wideband amplifier with a high input impedance and a low output impedance.

The output from the 'A' attenuator is a. c. coupled into the base of transistor VT3. At low frequencies VT3 functions as an amplifier with positive feedback to raise the input impedance of the stage, and some negative feedback, provided by R8, to stabilize the circuit. The positive feedback is applied through VT2, which samples the collector level of VT3 via the Zener diode MR1. A change in VT3 collector level causes a similar change in the base bias of VT2. This produces a proportional signal, in phase with the input signal, at VT3 emitter.

At high frequencies, VT3 acts as an emitter follower; VT2 simply providing the required d. c. levels and having no active part in the a. c. performance.

To give greater stability, the supply voltages for this circuit are provided by the 50 Mc/s Input Amplifier.

4.2 TM 7607: 50 Mc/s INPUT AMPLIFIER

The 'A' input signal from the impedance buffer is a. c. coupled into the base of VT1 by C1 for L. F., and C2 for H. F. where the electrolytic of C1 tends to become inductive. VT1 is similarly coupled to the phase splitter, VT2, VT3, the outputs of which are taken to drive the slope selection AND gates, VT4 and VT5.

The tunnel diode-transistor level detector, MR21-VT11, produces a very fast positive going edge from the slower, negative going input. The curves in Fig. 4.1 show typical characteristics and combined characteristics of the two active elements. The position of the load line, -1/RL, is a function of the trigger level control.

A period 'A' select or 'A' amplifier select signal will turn on VT17, which then couples the trigger level potentiometer to +6 V. The circuit shown in Fig. 4.2 now becomes effective.

Biasing is arranged such that with the trigger level control in the central position the load line approximately bisects the peak to valley distance; i. e., for constant current input drive minimum set and reset currents operate the switch. These values correspond to the minimum input drive to the counter for stable operation. Increased input drives enable selection of the trigger point by varying the load-line position with the trigger level control. At the extreme positions of the load lines, a large input drive is required to provide sufficient set or reset current drive.

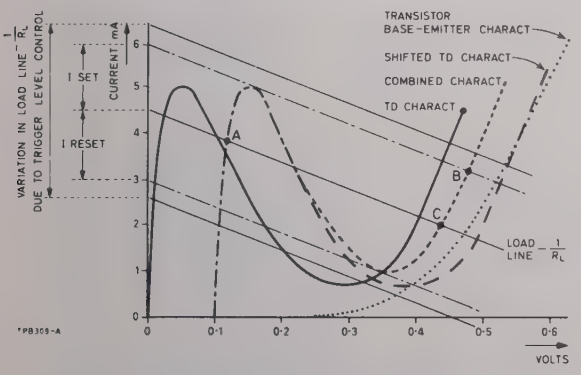


Fig. 4.1 Level detector characteristics

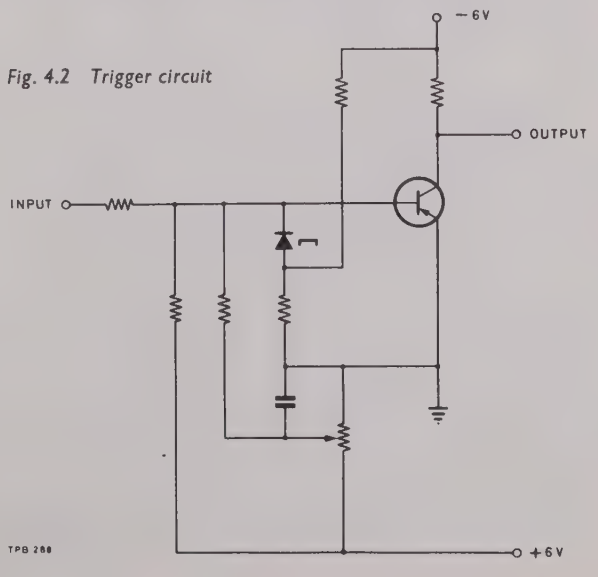


Fig. 4.2 Trigger circuit

Stability of this unit is improved through the use of local -12 V and -18 V regulators. The operation of these is similar to those described in the power supply for the main instrument.

4.3 TM 7605: GATE CONTROL and COUNT GATE UNIT

In the start signal gating, the time base signal is inverted by VT8 whose input is inhibited by a '1' state 'B' start select signal, through MR20. The signal is further gated with the time base start-stop select signal in the AND gate MR15-R42.

The 'B' amplifier signal is a.c. coupled into VT15, which forms part of the AND gate with MR17 and R44. A 'B' start select signal, applied to R44, provides a collector supply for VT15 and this opens the gate. Therefore, either the time base signal or 'B' signal is fed through the OR gate MR14-MR13, to the trigger MR12-VT14.

The operation of the trigger is similar to the level detector in the input amplifier unit, TM 7607, except that in this case there is no manual control of the position of the load line. Fig. 4.3 shows the typical combined tunnel diode/transistor characteristic of the trigger.

With no input signal the switch is in state A, very near the origin. When the input current step Δ Iin is applied, the load line is shifted as shown and the tunnel diode switches to state B, turning on the transistor. Removal of Δ Iin causes the tunnel diode to switch back to state A, thus turning off the transistor. The trigger output drives the start bistable circuit via amplifier VT12.

The start bistable (VT10, VT11) is a fast regenerative switch arranged so that it is off (both transistors off) when reset, and when switched on gives a very fast negative going output. To achieve reliable operation the drive to the bistable is inhibited, for the duration of the reset pulse, by VT13 which gates out the input to VT11 when turned on by the reset pulse. The first negative going spike after VT13 turns off, triggers the start bistable, producing the fast edge required to open the main counter gate. The gate is opened by VT23 turning on, thus providing the collector supply for the main gating transistor, VT21. The count signal, applied to the base of VT21, can now pass through to VT22. Manual starting is achieved by directly supplying the VT21 collector load with +6 V, switched by the GATE switch on the front panel.

Derivation of the stop signal is achieved in a manner similar to that for the start signal.

It is necessary to inhibit the drive to the stop bistable (VT4, VT3) until after the start bistable has been turned on. This is done by turning on VT9 (which then supplies the VT5 collector voltage) with the positive going output of the start bistable. The first negative going edge from VT5 will then trigger VT4, starting the regenerative switch action. The output of VT4 turns on VT20 which clamps VT21 collector to near earth, thus closing the main counter gate. The gate can be held open by generating the manual stop inhibit signal, which holds off VT9 thus inhibiting the drive to the stop bistable.

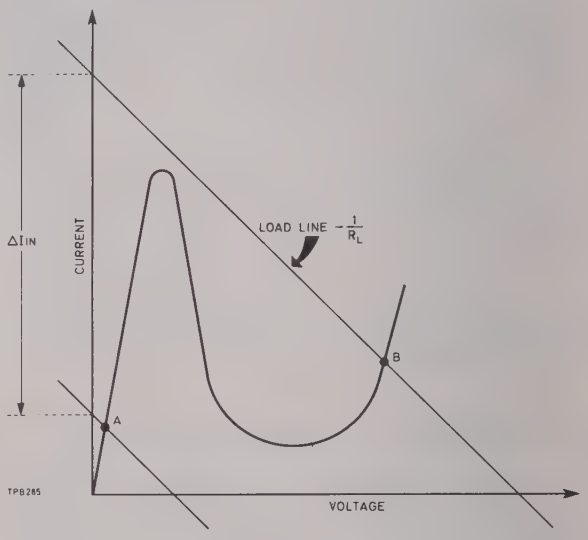


Fig. 4.3 Combined trigger characteristics

4.4 TM 7606 : 50 Mc/s DECADE COUNTING UNIT

The first bistable trigger circuit is formed by transistors VT4 and VT5, with cross-over networks R11, R15 and R12, R14. In this decade negative feedback is employed to achieve fast switching whilst operating basically in the saturated mode.

Consider the feedback effect on VT4. Diode MR7 has a high forward voltage drop and MR4 a

low forward voltage drop. Initially, during turn on, all current flows through the base (the voltage across MR4 is in the reverse direction). Thus the voltage at the junction of the diodes is given by the base-emitter voltage drop plus the forward voltage drop of MR7. As the transistor turns on the collector moves positively and when it reaches a potential such that MR4 begins to conduct, some current is supplied to R12 by the collector, so reducing the current for the base. Since the transistor is not saturated at the instant it turns off, there will be no storage time delay and the reverse bias provided by R14 will improve the switching time.

VT3 and VT6 speed switching and perform pulse routing. If VT4 is on and VT5 off there is no collector supply to VT3 and, although negative pulses are present at the base, there can be no signals at the collector. An input to VT6 switches the bistable; increased change-over speed being achieved since VT6 collector current causes VT5 collector voltage to rise towards earth potential.

Pre-gating and shaping of input pulses is carried out in the base drives of VT3 and VT6. Chokes L2 and L3 resonate with stray capacitance to provide overshoot and hence a faster rise time on the bistable output waveform.

The carry signal is taken from VT4 collector and inverted by VT1. VT1 is on in the reset state, but held at the end of saturation by diodes MR1 and MR2. To prevent loading the decade, the BCD output is taken from VT2, fed by VT5.

The three other bistable circuits are identical in operation to the first, and permutation follows the same principle as that used on the lower speed decades, TM 7448 (see Fig. 3.7 in the TF 2401A handbook). The feedback gating is performed by transistor VT14 (instead of a diode) which when turned on clamps the junction of C16, C17 to a near earth potential, and so prevents the flow of negative going trigger signals. The fourth bistable is two line driven as in the slower decades.

Note : The bistables in this unit are triggered by negative going pulses, but the output to trigger the next D. C. U. is positive going.

4.5 TM 7608 : 10 Mc/s MULTIPLIER

The 1 Mc/s output of the crystal oscillator is fed to the emitter follower VT1, and then via the grounded emitter stages, VT2 and VT3, to drive the X5 multiplier. VT2 and VT3 shape the input signal, producing sharp pulses to make the tuned circuit, T1-C3, ring.

VT5, with the tuned circuit T2-C4, is the X2 multiplier which produces the 10 Mc/s output. The following stage (VT6) gives amplification.

For time interval measurement both 10 Mc/s and 1 Mc/s are required and the appropriate select signal determines which frequency is used. MR4 /R19 and VT7/R16 act as AND gates and their outputs are fed through the OR gate, MR6-MR3, to the output stage, VT8.

Section 5

Maintenance notes

5.1 GENERAL

This section of the manual is intended as a general guide to the servicing of the unit. In case of difficulties that cannot be resolved with the aid of this book, please contact our Service Division, at the address on the rear cover or your nearest Marconi Instruments representative. Always mention the type number and serial number of your unit.

Power supplies and non-critical signals are connected to the counter by a 36-way Amphenol plug. Snap-on BNC plugs and sockets connect the more critical signals.

If it is found necessary to check the performance of the unit, this should be done in conjunction with a TF2401A and a Function unit, both of which are working correctly.

5.2 REMOVING PLUG-IN CIRCUIT UNITS

Because critical signals are taken from one board to the next by direct links, using stake pins, the input amplifier, gate control and decade boards must be removed as one unit. This is done by means of the printed board screw jack which should be inserted in the hole in the underside of the unit. The boards may be separated once they have been removed.

Note : Before attempting to remove the boards, disconnect the miniature plug from the amplifier board.

5.3 ACCESS TO BUFFER BOARD and ATTENUATOR

The buffer board, located behind the front panel, should give long trouble free service, but if a fault occurs it is recommended that the unit be returned to our Service Division for repair.

Should you, however, decide to service the board yourself, it must be noted that the Range unit cannot be plugged into the Counter when it is dismantled, and therefore power supplies are not normally available for testing the board. Also, great care must be taken to prevent wires being broken off the board. Earth connections which are removed must be reconnected to their original positions.

Access to the board, and the other components behind the front panel, is obtained by the following procedure :-

(1) Remove top cover.

(2) Remove the three printed circuit boards (see Section 5. 2).

(3) Disconnect the earth link to the buffer board. The link is made on the bottom of the unit, to an earth tag.

(4) Remove the two C-washers holding locking screw to back panel, and withdraw locking screw.

(5) Remove the four screws (two in each side) holding the front panel in place.

(6) Remove remaining screws in the side not holding Multiplier board cover; slacken screws in other side. This allows the side panels to splay and the front panel to hinge down on its cableform.

(7) Lay unit on its side and hinge out front panel.

(8) Remove screw in top of cover over the board (cover which holds grommet). Remove cover for access to component side of board. Slip grommet out of hole to make access to board easier.

(9) Withdraw the four screws, one at each corner of the board. The board will now hinge on cableform allowing access to printed wiring.

(10) Remove the two screws holding the small bottom panel in place. This gives limited access to the input socket and slope switch.

(11) Removing screw in either side of box, holding board, allows box to be removed and access is given to the attenuator etc.

5.4 SETTING UP THE 10 Mc/s MULTIPLIER

The multiplier board is covered by a screening can which may be removed by withdrawing a screw on the side of the Range unit.

The following procedure may be carried out with the printed circuit board on an extender board. However, slight retuning may be required when the board is fitted into its screening can.

Test gear required :

Oscilloscope. 15 Mc/s bandwidth. (Marconi Instruments Types TF 1330 and TF 2200.)

(1) Set the FUNCTION switch to TEST, and the INTERNAL-EXTERNAL switch to INTERNAL.

(2) Connect the oscilloscope probe to pin B of transformer T1 and adjust the slug to give maximum amplitude (approximately 8 V p-p) at 5 Mc/s frequency.

(3) Connect the probe to VT5 collector and adjust the slug of transformer T2 to give maximum amplitude of the signal at 10 Mc/s frequency.

5.5 SETTING UP THE 50 Mc/s MULTIPLIER

Note : When performing the setting-up procedure, only the amplifier board should be plugged into the Range unit. Before starting to set up the amplifier allow a warm-up period of about 5 minutes.

Phase splitter

The collector currents of the phase splitter are balanced by selecting resistor R8 which shunts R6. Should a fault occur which affects these currents, it will show as an imbalance in the triggering ranges of the positive and negative slopes of an input. For an input near the minimum level, triggering may occur over almost the whole range for one slope, and only a very small part of the range for the other slope.

When the fault has been corrected it may be necessary to reselect R8 to balance the collector currents again; this can be done as follows :-

(1) Connect a 20 kΩ test potentiometer across R6, and monitor on TP1 (on the back of the board) with a d.c. coupled oscilloscope of 100 mV/cm sensitivity (e.g., TF 2200 or TF 2202).

(2) With no input signal, adjust the potentiometer until the oscilloscope shows no shift in level when the unit SLOPE switch is moved from + to -.

Measure the resistance of the potentiometer and insert a selected resistor of the appropriate value. Recheck as in (2) above, with the resistor in place of the potentiometer.

Amplifier, VT1

Capacitor C3 is selected for optimum frequency response of the A Input amplifier.

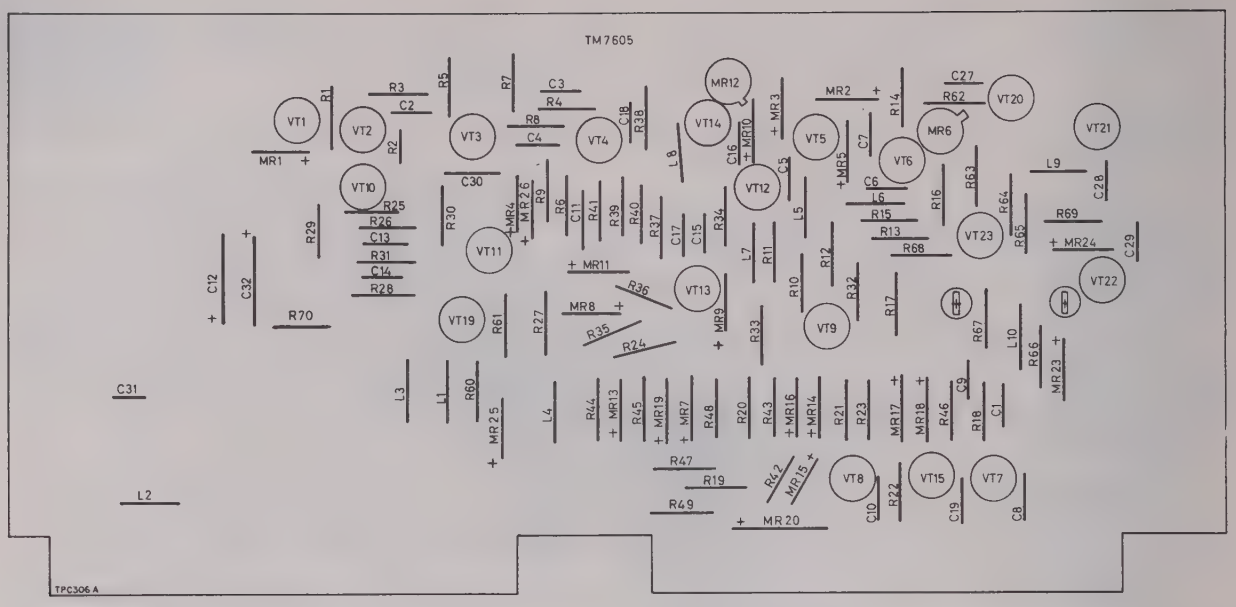


Fig. 5.1 Gate Control and Count Gate Board TM 7605

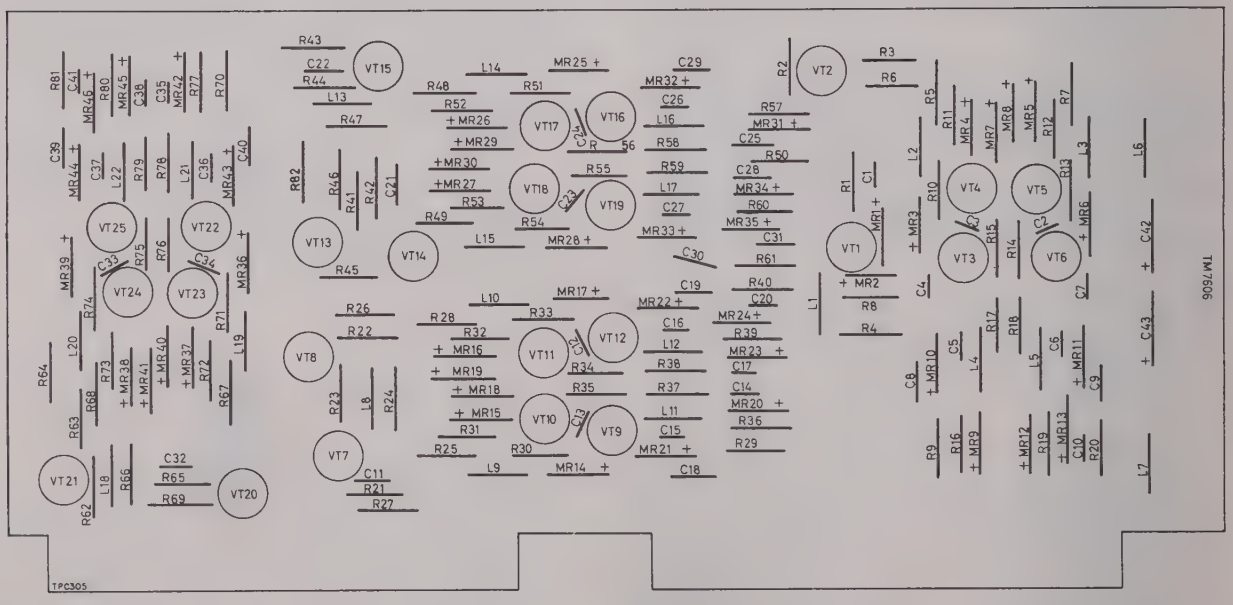


Fig. 5.2 50 Mc/s D.C.U. Board TM 7606

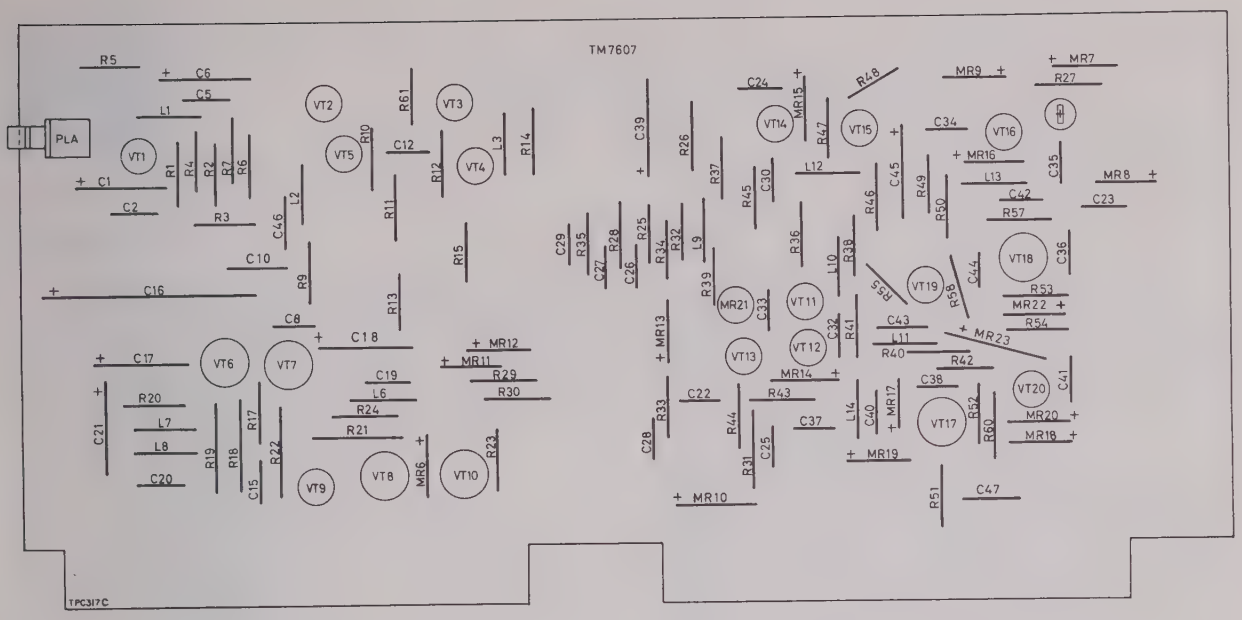


Fig. 5.3 50 Mc/s Amplifier Board TM 7607

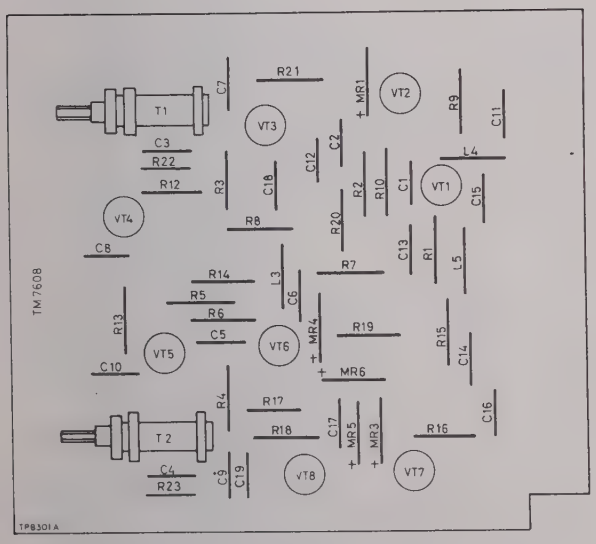


Fig. 5.4 10 Mc s Multiplier and T.I.M. Gates Board TM 7608

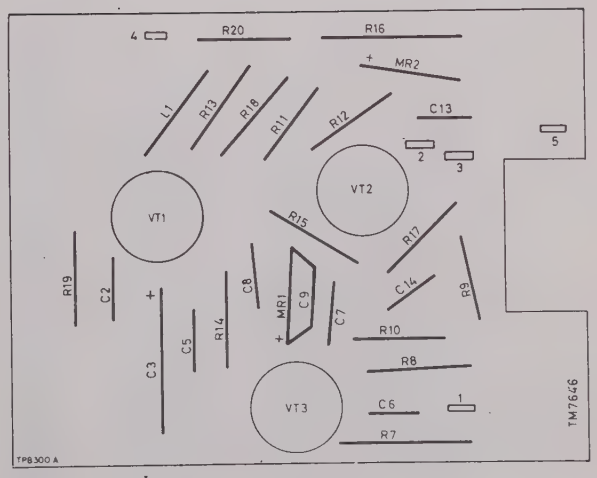


Fig. 5.5 Buffer Board TM 7646

Section 6

Replaceable parts

Introduction

This section lists replaceable parts in alphabetical order of their circuit reference, with miscellaneous parts at the end of the list. A separate parts list is given for each circuit diagram. The following abbreviations are used:

Carb	:	carbon
Cer	:	ceramic
DPDT	:	double pole, double throw
Elec	:	electrolytic
G	:	conductance
Min	:	minimum
Plas	:	plastic
Pos	:	position
SPST	:	single pole, single throw
Var	:	variable
WW	:	wire wound
*	:	selected during test; nominal value listed

Note: Throughout the lists resistor wattages are referred to 70°C unless otherwise stated.

Ordering

When ordering replacement parts address the order to our Service Division. Specify the following information for each part required:

1) Type and serial number of instrument
2) Board title and TM number
3) Circuit reference
4) Description
5) M.I. code number

If a part is not listed, state its function, location and description when ordering.

Semiconductor types

The M.I. code against each diode or transistor refers, generally, to more than one type of semiconductor. These types are listed below against the M.I. code number.

DIODES

90441:	CMC4300164;	1N759A			
90442:	CMC4300165;	1N753A			
90443:	CMC4300172;	1N718A;	HS2150		
90444:	CMC4300178;	1N708A;	1N752A;	1S7056A	
90445:	CMC4300179;	EVR20B;	1R203		
91003:	CMC4300120;	1N34A/G;	1N34A		
91004:	CMC4300141;	S3237G			
91005:	CMC4300142;	1N458			
91006:	CMC4300158;	1N3063;	U16003		
91007:	CMC4300160;	S555G;	1N995;	HD1870	
92003:	CMC4300149;	1N2069;	1N2069A;	CER68C	
92004:	CMC4300150;	CER71A			
92005:	CMC4300161;	SOD100D			
93003:	CMC4300169;	1N3562;	LT2026		
97002:	CMC4906078;	2N1595			

TRANSISTORS

94003:	CMC4906075;	2N1241			
95008:	CMC4906009;	2N404			
95010:	CMC4906041;	SM644			
95011:	CMC4906046;	SA636;	2N2001		
95012:	CMC4906047;	2N1303			
95013:	CMC4906049;	SP1685;	2N669		
95014:	CMC4906052;	2N1038;	CP1213		
95015:	CMC4906060;	SM2034;	2N976		
95016:	CMC5906065;	SM2035;	SM642		
95018:	CMC4906077;	SP1686;	2N1544		
95511:	CMC4906038;	2N708;	S5900;	U16004	
95512:	CMC4906043;	SM4998;	U16005		
95513:	CMC4906045;	2N709;	U16006		
95514:	CMC4906063;	U16007;	2N1990S;	SM2128	
95515:	CMC4906071;	SM5902;	U16008;	CET247	
95516:	CMC4906072;	U16009;	2N2369;	CET248	
95517:	CMC4906073;	SM5901;	U16010;	CET249	
95519:	2N2369S;	U16011			
96501:	CMC4906048;	2N1302			
97001:	CMC4906076;	2N2386;	W112		

Chassis

Circuit reference	Description	M.I. code
CAPACITORS		
C102	Cer 56pF ±5% 750V	26324-851
C103	Plas 68pF ±2pF 350V	26516-202
C104	Plas 390pF ±5% 125V	26516-388
C105	Plas 0.0015μF ±2% 125V	26516-524
C106	Paper 0.004μF ±10% 250V	26174-137
C107	Plas 47pF ±2pF 350V	26516-167
C108	Plas 0.1μF ±10% 250V	26512-228
C109	Cer 0.001μF min 350V	26372-611
C110	Cer 0.001μF min 350V	26372-611
C111	Cer 0.001μF min 350V	26372-611
C112	Cer 0.001μF min 350V	26372-611
C113	Cer 0.001μF min 350V	26372-611
C114	Cer 0.001μF min 350V	26372-611
C115	Cer 0.001μF min 350V	26372-611
C116	Elec 25μF -20% +100% 18V	26417-141
C117	Plas 300pF ±2% 125V	26516-358
PLUGS		
PL102	36 way	23435-412
PL136	Coaxial	23443-020
PL137	Coaxial	23443-020
PL138	Coaxial	23443-020
PL139	Coaxial	23443-020
RESISTORS		
R101	Carb 47Ω ±5% ¼W	24332-037
R102	Carb 750kΩ ±5% ½W	24010-020
R103	Carb 270kΩ ±5% ¼W	24332-746
R104	Carb 47kΩ ±5% ¼W	24332-726
R105	Carb 12kΩ ±5% ¼W	24332-712
R106	Carb 3.9kΩ ±5% ¼W	24332-696
R107	Carb 47Ω ±10% ¼W	24342-037
R108	Carb 4.7kΩ ±10% 1/10W	24341-300
RV202	Special Var 1kΩ TRIGGER LEVEL (with S207)	44324-715

Circuit reference	Description	M.I. code
SOCKETS		
SK129	Coaxial (with cable)	43123-028
SK201	Coaxial	23443-448
SWITCHES		
S206	SPST SLOPE A	23462-252
S207	6 pos ATTENUATOR (with RV202)	44324-715
KNOBS		
	TRIGGER LEVEL 11/16" dia	41141-601
	ATTENUATOR 1" dia	41141-304
	Jacking screw	41112-513

Impedance Buffer: TM 7646

CAPACITORS		
C2	Cer 27pF ±10% 500V	26383-160
C3	Elec 47μF ±20% 6V	26010-036
C5	Cer 220pF ±10% 500V	26383-205
C6	Cer 15pF ±10% 500V	26383-346
C7	Cer 10pF ±5% 500V	26343-336
C8	Cer 10pF ±5% 500V	26343-336
C9	Cer 0.02μF +50% -25% 12V	26383-007
C13	Cer 0.1μF ±20% 25V	26010-030
C14	Cer 0.1μF ±20% 25V	26010-030
L1	Inductor 0.47μH ±10%	23010-023
L2	Inductor 82μH ±10%	23010-031

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
DIODES		
MR1	15V Zener	MIP 90443
MR2	6.2V Zener (low power)	MIP 90442
RESISTORS		
R7	Carb 100kΩ ±5% ¼W	24332-135
R8	Carb 1.8MΩ ±5% 1/10W	24331-372
R9	Carb 3.6kΩ ±5% 1/10W	24331-295
R10	Carb 10kΩ ±5% 1/10W	24331-310
R11	Carb 1.5kΩ ±5% 1/10W	24331-284
R12	Carb 560Ω ±5% 1/10W	24331-272
R13	Carb 12kΩ ±5% 1/10W	24331-312
R14	Carb 1kΩ ±5% 1/10W	24331-280
R15	Carb 1kΩ ±5% 1/10W	24331-280
R16	Carb 390Ω ±5% ¼W	24332-065
R17	Carb 82kΩ ±5% 1/10W	24331-333
R18	Carb 1.2kΩ ±5% 1/10W	24331-282
R19	Carb 75Ω ±5% 1/10W	24331-244
R20	Carb 220Ω ±5% ¼W	24332-658
SKTA	Socket, coaxial (with cable)	43123-028
TRANSISTORS		
VT1	High speed - planar	MIP 95516
VT2	High speed - planar	MIP 95515
VT3	High speed - planar	MIP 95519

50 Mc/s Amplifier: TM 7607

Circuit reference	Description	M.I. code
CAPACITORS		
C1	Elec 47µF ±20% 6V	26010-036
C2	Cer 220pF ±10% 500V	26383-205
C4	Plas 56pF *	139TM7557A
C5	Cer 220pF ±10% 500V	26383-205
C6	Elec 50µF +100% -20% 25V	26417-152
C8	Cer 0.1µF +50% -25% 25V	26383-031
C10	Cer 0.1µF +50% -25% 25V	26383-031
C12	Cer 0.1µF +50% -25% 25V	26383-031
C15	Cer 0.1µF +50% -25% 25V	26383-031
C16	Elec 50µF +100% -20% 25V	26417-152
C17	Elec 2µF +100% -20% 25V	26414-109
C18	Elec 2µF +100% -20% 25V	26414-109
C19	Cer 0.1µF +50% -25V 25V	26383-031
C20	Cer 0.1µF +80% -20% 10V	26382-214
C21	Elec 2µF +100% -20% 25V	26414-109
C22	Cer 0.1µF +80% -20% 10V	26382-214
C23	Cer 0.1µF +80% -20% 10V	26382-214
C24	Cer 0.1µF +80% -20% 10V	26382-214
C25	Cer 0.1µF +80% -20% 10V	26382-214
C26	Cer 0.1µF +80% -20% 10V	26382-214
C27	Cer 0.1µF +80% -20% 10V	26382-214
C28	Cer 0.02µF +50% -25% 12V	26383-007
C29	Cer 15pF ±10% 500V	26343-346
C30	Cer 0.1µF +80% -20% 10V	26382-214
C32	Cer 15pF ±10% 500V	26343-346
C33	Cer 10pF ±5% 500V	26343-336
C34	Cer 22pF ±10% 500V	26383-157
C35	Cer 15pF ±10% 500V	26343-346
C36	Cer 0.1µF +80% -20% 10V	26382-214
C37	Cer 0.1µF +80% -20% 10V	26382-214
C38	Cer 0.1µF +80% -20% 10V	26382-214
C39	Elec 25µF +100% -20% 6V	26412-243
C40	Cer 0.1µF +80% -20% 10V	26382-214
C41	Cer 0.1µF +80% -20% 10V	26382-214

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
C42	Cer 0.1μF +80% -20%10V	26382-214
C43	Cer 15pF ±10% 500V	26343-346
C44	Cer 47pF ±10%	26383-170
C45	Elec 25μF +100% -20% 6V	26412-243
C46	Cer 0.1μF +80% -20% 10V	26382-214
C47	Cer 0.1μF +50% -25% 25V	26383-031
INDUCTORS		
L1	1μH ±10%	23010-025
L2	1μH ±10%	23010-025
L3	1μH ±10%	23010-025
L6	82μH ±10%	23010-031
L7	82μH ±10%	23010-031
L8	82μH ±10%	23010-031
L9	82μH ±10%	23010-031
L10	1μH ±10%	23010-025
L11	1μH ±10%	23010-025
L12	1μH ±10%	23010-025
L13	1μH ±10%	23010-025
L14	82μH ±10%	23010-031
DIODES		
MR6	Medium current	MIP 92003
MR7	General purpose	MIP 91003
MR8	Silicon planar	MIP 91006
MR9	Silicon planar	MIP 91006
MR10	High G	MIP 91004
MR11	Silicon planar	MIP 91006
MR12	Silicon planar	MIP 91006
MR13	Silicon planar	MIP 91006
MR14	Fast switching, high G	MIP 91007
MR15	Fast switching, high G	MIP 91007
MR16	Fast switching, high G	MIP 91007
MR17	High G	MIP 91004
MR18	High G	MIP 91004
MR19	High G	MIP 91004
MR20	High G	MIP 91004
MR21	Tunnel diode	MIP 93003
MR22	Fast switching, high G	MIP 91007
MR23	Silicon planar	MIP 91006
PL129	Coaxial plug	23010-012
RESISTORS		
R1	Carb 2kΩ ±5% ¼W	24332-687
R2	Carb 2.2kΩ ±5% ¼W	24332-688
R3	Carb 820Ω ±5% ¼W	24332-678
R4	Carb 270Ω ±5% ¼W	24332-661
R5	Carb 100Ω ±5% 1/10W	24331-250
R6	Carb 1.3kΩ ±5% ¼W	24332-683
R7	Carb 5.1kΩ ±5% ¼W	24332-701
R8	Carb 27kΩ *	140TM7557A
R9	Carb 390Ω ±5% 1/10W	24331-265
R10	Carb 62Ω ±5% 1/10W	24331-241
R11	Carb 510Ω ±5% 1/10W	24331-270
R12	Carb 75Ω ±5% 1/10W	24331-244
R13	Carb 6.2kΩ ±5% ¼W	24332-704
R14	Carb 470Ω ±5% 1/10W	24331-269
R15	Carb 1.5kΩ ±5% 1/10W	24331-284
R17	Carb 200Ω ±5% ¼W	24332-657
R18	Carb 715Ω ±1% 1/8W	24010-008
R19	Carb 1.74kΩ ±1% 1/8W	24010-010
R20	Carb 200Ω ±5% ¼W	24332-657
R21	Carb 2.43kΩ ±1% 1/8W	24010-014
R22	Carb 2.61Ω ±1% 1/8W	24010-017
R23	Carb 22Ω ±5% ¼W	24332-628
R24	Carb 3.9kΩ ±5% ¼W	24332-696
R25	Carb 10kΩ ±5% 1/10W	24331-310
R26	Carb 10kΩ ±5% 1/10W	24331-310
R27	Carb 360Ω ±5% 1/10W	24331-264
R28	Carb 10kΩ ±5% 1/10W	24331-310
R29	Carb 150Ω ±5% ¼W	24332-654
R30	Carb 150Ω ±5% ¼W	24332-654
R31	Carb 1kΩ ±5% 1/10	24331-280
R32	Carb 10kΩ ±5% 1/10W	24331-310
R33	Carb 1.5kΩ ±5% 1/10W	24331-284

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
R34	Carb 180Ω ±5% ¼W	24332-656
R35	Carb 240Ω ±5% 1/10W	24331-259
R36	Carb 5.6kΩ ±5% 1/10W	24331-303
R37	Carb 470Ω ±5% 1/10W	24331-269
R38	Carb 220Ω ±5% ¼W	24332-658
R39	Carb 10Ω ±5% 1/10W	24331-220
R40	Carb 560Ω * 1/10W	24331-272
R41	Carb 10kΩ ±5% 1/10W	24331-310
R42	Carb 270Ω ±5% ¼W	24332-661
R43	Carb 2.7kΩ ±5% 1/10W	24331-292
R44	Carb 1.5kΩ ±5% 1/10W	24331-284
R45	Carb 6.2kΩ ±5% ¼W	24332-704
R46	Carb 180Ω ±5% ¼W	24332-656
R47	Carb 2.2kΩ ±5% ¼W	24332-688
R48	Carb 470Ω ±5% 1/10W	24331-269
R49	Carb 4.3kΩ ±5% 1/10W	24331-298
R50	Carb 270Ω ±5% ¼W	24332-661
R51	Carb 4.7kΩ ±5% 1/10W	24331-300
R52	Carb 2.2kΩ ±5% ¼W	24332-688
R53	Carb 5.6kΩ ±5% 1/10W	24331-303
R54	Carb 1kΩ ±5% 1/10W	24331-280
R55	Carb 10kΩ ±5% 1/10W	24331-310
R57	Carb 180Ω ±5% ¼W	24332-656
R58	Carb 10kΩ ±5% 1/10W	24331-310
R60	Carb 180Ω ±5% ¼W	24332-656
R61	Carb 100Ω ±5% 1/10W	24331-250

TRANSISTORS

VT1	High speed, planar	MIP 95516
VT2	High speed, planar	MIP 95516
VT3	High speed, planar	MIP 95516
VT4	High speed, planar	MIP 95516
VT5	High speed, planar	MIP 95516
VT6	General purpose	MIP 95008
VT7	Medium power	MIP 95512
VT8	Medium power	MIP 95512
VT9	High voltage	MIP 95514
VT10	General purpose	MIP 95008
VT11	High speed	MIP 95015
VT12	High speed, planar	MIP 95516
VT13	High speed, planar	MIP 95516
VT14	High speed, epitaxial	MIP 95016
VT15	High speed, epitaxial	MIP 95016
VT16	High speed, planar	MIP 95516
VT17	General purpose	MIP 95008
VT18	General purpose	MIP 95008
VT19	High speed, planar	MIP 95516
VT20	High speed, epitaxial	MIP 95016

50 Mc/s Gate Control and Count Gate: TM 7605

CAPACITORS

C1	Cer	0.1μF +80% -20% 10V	26382-214
C2	Cer	39pF ±10% 500V	26383-168
C3	Cer	22pF ±10% 500V	26383-157
C4	Cer	22pF ±10% 500V	26383-157
C5	Cer	39pF ±10% 500V	26383-168
C6	Cer	47pF ±10% 500V	26383-170
C7	Cer	220pF ±10% 500V	26383-205
C8	Cer	100pF ±10% 500V	26383-187
C9	Cer	0.1μF +80% -20% 10V	26382-214
C10	Cer	39pF ±10% 500V	26383-168
C11	Cer	0.1μF +50% -25% 25V	26383-031
C12	Elec	22μF ±20% 10V	26010-033
C13	Cer	22pF ±10% 500V	26383-157
C14	Cer	22pF ±10% 500V	26383-157
C15	Cer	39pF ±10% 500V	26383-168
C16	Cer	47pF ±10% 500V	26383-170
C17	Cer	0.002μF ±25% 300V	26383-276
C18	Cer	220pF ±10% 500V	26383-205
C19	Cer	100pF ±10% 500V	26383-187
C27	Cer	15pF ±10% 500V	26343-346
C28	Cer	15pF ±10% 500V	26343-346
C29	Cer	0.1μF +80% -20% 10V	26382-214

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
C30	Cer 0.1μF +80% -20% 10V	26382-214
C31	Cer 0.1μF +50% -25% 25V	26383-031
C32	Elec 22μF ±20% 10V	26010-033
INDUCTORS		
L1	82μH ±10%	23010-031
L2	82μH ±10%	23010-031
L3	82μH ±10%	23010-031
L4	82μH ±10%	23010-031
L5	1μH ±10%	23010-025
L6	1μH ±10%	23010-025
L7	1μH ±10%	23010-025
L8	1μH ±10%	23010-025
L9	1μH ±10%	23010-025
L10	1μH ±10%	23010-025
DIODES		
MR1	High G	MIP 91004
MR2	Silicon planar	MIP 91006
MR3	Silicon planar	MIP 91006
MR4	General purpose	MIP 91003
MR5	Fast - high G	MIP 91007
MR6	Tunnel diode	MIP 93003
MR7	Silicon planar	MIP 91006
MR8	Silicon planar	MIP 91006
MR9	Silicon planar	MIP 91006
MR10	Fast - high G	MIP 91007
MR11	General purpose	MIP 91003
MR12	Tunnel diode	MIP 93003
MR13	Silicon planar	MIP 91006
MR14	Silicon planar	MIP 91006
MR15	High G	MIP 91004
MR16	Silicon planar	MIP 91006
MR17	Silicon planar	MIP 91006
MR18	Silicon planar	MIP 91006
MR19	Silicon planar	MIP 91006
MR20	High G	MIP 91004
MR23	Fast - high G	MIP 91007
MR24	Silicon planar	MIP 91006
MR25	High G	MIP 91004
MR26	High G	MIP 91004
RESISTORS		
R1	Carb 560Ω ±5% 1/10W	24331-272
R2	Carb 62kΩ ±5% 1/10W	24331-330
R3	Carb 2.2kΩ ±5% 1/10W	24331-288
R4	Carb 2.2kΩ ±5% 1/10W	24331-288
R5	Carb 560Ω ±5% 1/10W	24331-272
R6	Carb 12kΩ ±5% 1/10W	24331-312
R7	Carb 22kΩ ±5% 1/10W	24331-318
R8	Carb 2.2kΩ ±5% 1/10W	24331-288
R9	Carb 560Ω ±5% 1/10W	24331-272
R10	Carb 220Ω ±5% ¼W	24332-658
R11	Carb 560Ω ±5% 1/10W	24331-272
R12	Carb 4.3kΩ ±5% 1/10W	24331-298
R13	Carb 390Ω ±5% 1/10W	24331-265
R14	Carb 6.8Ω ±5% ¼W	24332-616
R15	Carb 220Ω ±5% ¼W	24332-658
R16	Carb 1kΩ ±5% 1/10W	24331-280
R17	Carb 180Ω ±5% ¼W	24332-656
R18	Carb 3.3kΩ ±5% 1/10W	24331-294
R19	Carb 270Ω ±5% ¼W	24332-661
R20	Carb 10kΩ ±5% 1/10W	24331-310
R21	Carb 1kΩ ±5% 1/10W	24331-280
R22	Carb 2.2kΩ ±5% 1/10W	24331-288
R23	Carb 5.6kΩ ±5% 1/10W	24331-303
R24	Carb 1kΩ ±5% 1/10W	24331-280
R25	Carb 560Ω ±5% 1/10W	24331-272
R26	Carb 2.2kΩ ±5% 1/10W	24331-288
R27	Carb 27kΩ ±5% 1/10W	24331-320
R28	Carb 1.8kΩ ±5% 1/10W	24331-286
R29	Carb 18kΩ ±5% 1/10W	24331-316
R30	Carb 560Ω ±5% 1/10W	24331-272
R31	Carb 2.2kΩ ±5% 1/10W	24331-288
R32	Carb 1kΩ ±5% 1/10W	24331-280
R33	Carb 220Ω ±5% ¼W	24332-658
R34	Carb 4.3kΩ ±5% 1/10W	24331-298

For symbols and abbreviations see introduction to this section

Circuit reference		Description	M.I. code
R35	Carb	4.7kΩ ±5% 1/10W	24331-300
R36	Carb	2.2kΩ ±5% 1/10W	24331-288
R37	Carb	220Ω ±5% ¼W	24332-658
R38	Carb	6.8Ω ±5% ¼W	24332-616
R39	Carb	390Ω ±5% 1/10W	24331-265
R40	Carb	1kΩ ±5% 1/10W	24331-280
R41	Carb	180Ω ±5% ¼W	24332-656
R42	Carb	150Ω ±5% ¼W	24332-654
R43	Carb	10kΩ ±5% 1/10W	24331-310
R44	Carb	270Ω ±5% ¼W	24332-661
R45	Carb	10kΩ ±5% 1/10W	24331-310
R46	Carb	3.3kΩ ±5% 1/10W	24331-294
R47	Carb	270Ω ±5% ¼W	24332-661
R48	Carb	10kΩ ±5% 1/10W	24331-310
R49	Carb	560Ω ±5% 1/10W	24331-272
R60	Carb	100Ω ±5% ¼W	24332-650
R61	Carb	2.2kΩ ±5% 1/10W	24331-288
R62	Carb	1kΩ ±5% 1/10W	24331-280
R63	Carb	1.8kΩ ±5% 1/10W	24331-286
R64	Carb	180Ω ±5% ¼W	24332-656
R65	Carb	4.3kΩ ±5% 1/10W	24331-298
R66	Carb	4.3kΩ ±5% 1/10W	24331-298
R67	Carb	220Ω ±5% ¼W	24332-658
R68	Carb	220Ω ±5% ¼W	24332-658
R69	Carb	560Ω ±5% 1/10W	24331-272
R70	Carb	1.8kΩ ±5% 1/10W	24331-286

TRANSISTORS

VT1	High speed - planar	MIP 95511
VT2	High speed - planar	MIP 95511
VT3	High speed - planar	MIP 95511
VT4	High speed - epitaxial	MIP 95010
VT5	High speed - planar	MIP 95516
VT6	High speed - epitaxial	MIP 95010
VT7	High speed - epitaxial	MIP 95010
VT8	High speed - epitaxial	MIP 95010
VT9	High speed - planar	MIP 95511
VT10	High speed - planar	MIP 95511
VT11	High speed - epitaxial	MIP 95010
VT12	High speed - planar	MIP 95516
VT13	High speed - epitaxial	MIP 95010
VT14	High speed - epitaxial	MIP 95010
VT15	High speed - epitaxial	MIP 95010
VT19	General purpose	MIP 96501
VT20	High speed - planar	MIP 95516
VT21	High speed - planar	MIP 95516
VT22	High speed - planar	MIP 95516
VT23	High speed - planar	MIP 95516

50 Mc/s D.C.U.: TM 7606

CAPACITORS

C1	Cer	22pF ±5% 500V	26010-007
C2	Cer	33pF ±5% 500V	26010-010
C3	Cer	33pF ±5% 500V	26010-010
C4	Cer	10pF ±5% 500V	26010-003
C5	Cer	75pF ±5% 500V	26010-013
C6	Cer	75pF ±5% 500V	26010-013
C7	Cer	10pF ±5% 500V	26010-003
C8	Cer	0.1μF +80% -20% 10V	26382-214
C9	Cer	0.1μF +80% -20% 10V	26382-214
C10	Cer	100pF ±5% 500V	26010-017
C11	Cer	22pF ±5% 500V	26010-007
C12	Cer	33pF ±5% 500V	26010-010
C13	Cer	33pF ±5% 500V	26010-010
C14	Cer	10pF ±5% 500V	26010-003
C15	Cer	75pF ±5% 500V	26010-013
C16	Cer	75pF ±5% 500V	26010-013
C17	Cer	10pF ±5% 500V	26010-003
C18	Cer	0.1μF +80% -20% 10V	26382-214
C19	Cer	0.1μf +80% -20% 10V	26382-214
C20	Cer	100pF ±5% 500V	26010-017
C21	Cer	22pF ±5% 500V	26010-007
C22	Cer	22pF ±5% 500V	26010-007
C23	Cer	33pF ±5% 500V	26010-010
C24	Cer	33pF ±5% 500V	26010-010

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
C25	Cer 10pF ±5% 500V	26010-003
C26	Cer 75pF ±5% 500V	26010-013
C27	Cer 75pF ±5% 500V	26010-013
C28	Cer 10pF ±5% 500V	26010-003
C29	Cer 0.1µF +80% -20% 10V	26382-214
C30	Cer 0.1µF +80% -20% 10V	26382-214
C31	Cer 100pF ±5% 500V	26010-017
C32	Cer 22pF ±5% 500V	26010-007
C33	Cer 33pF ±5% 500V	26010-010
C34	Cer 33pF ±5% 500V	26010-010
C35	Cer 10pF ±5% 500V	26010-003
C36	Cer 75pF ±5% 500V	26010-013
C37	Cer 75pF ±5% 500V	26010-013
C38	Cer 10pF ±5% 500V	26010-003
C39	Cer 0.1µF +80% -20% 10V	26382-214
C40	Cer 0.1µF +80% -20% 10V	26382-214
C41	Cer 100pF ±5% 500V	26010-017
C42	Elec 2µf +100% -20% 25V	26414-109
C43	Elec 2µf +100% -20% 25V	26414-109
INDUCTORS		
L1	1µH ±10%	23010-025
L4	1µH ±10%	23010-025
L5	1µH ±10%	23010-025
L6	82µH ±10%	23010-031
L7	82µH ±10%	23010-031
L8	1µH ±10%	23010-025
L11	1µH ±10%	23010-025
L12	1µH ±10%	23010-025
L13	1µH ±10%	23010-025
L16	1µH ±10%	23010-025
L17	1µH ±10%	23010-025
L18	1µH ±10%	23010-025
L21	1µH ±10%	23010-025
L22	1µH ±10%	23010-025
DIODES		
MR1	Silicon planar	MIP 91006
MR2	Fast switching, high G	MIP 91007
MR3	Fast switching, high G	MIP 91007
MR4	Fast switching, high G	MIP 91007
MR5	Fast switching, high G	MIP 91007
MR6	Fast switching, high G	MIP 91007
MR7	Silicon planar	MIP 91006
MR8	Silicon planar	MIP 91006
MR9	Fast switching, high G	MIP 91007
MR10	Fast switching, high G	MIP 91007
MR11	Fast switching, high G	MIP 91007
MR12	Fast switching, high G	MIP 91007
MR13	Silicon planar	MIP 91006
MR14	Fast switching, high G	MIP 91007
MR15	Fast switching, high G	MIP 91007
MR16	Fast switching, high G	MIP 91007
MR17	Fast switching, high G	MIP 91007
MR18	Silicon planar	MIP 91006
MR19	Silicon planar	MIP 91006
MR20	Fast switching, high G	MIP 91007
MR21	Fast switching, high G	MIP 91007
MR22	Fast switching, high G	MIP 91007
MR23	Fast switching, high G	MIP 91007
MR24	Silicon planar	MIP 91006
MR25	Fast switching, high G	MIP 91007
MR26	Fast switching, high G	MIP 91007
MR27	Fast switching, high G	MIP 91007
MR28	Fast switching, high G	MIP 91007
MR29	Silicon planar	MIP 91006
MR30	Silicon planar	MIP 91006
MR31	Fast switching, high G	MIP 91007

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
MR32	Fast switching, high G	MIP 91007
MR33	Fast switching, high G	MIP 91007
MR34	Fast switching, high G	MIP 91007
MR35	Silicon planar	MIP 91006
MR36	Fast switching, high G	MIP 91007
MR37	Fast switching, high G	MIP 91007
MR38	Fast switching, high G	MIP 91007
MR39	Fast switching, high G	MIP 91007
MR40	Silicon planar	MIP 91006
MR41	Silicon planar	MIP 91006
MR42	Fast switching, high G	MIP 91007
MR43	Fast switching, high G	MIP 91007
MR44	Fast switching, high G	MIP 91007
MR45	Fast switching, high G	MIP 91007
MR46	Silicon planar	MIP 91006

RESISTORS

Circuit reference	Description	M.I. code
R1	Carb 1kΩ ±5% 1/10W	24331-280
R2	Carb 22kΩ ±5% 1/10W	24331-318
R3	Carb 1kΩ ±5% 1/10W	24331-280
R4	Carb 270Ω ±5% ¼W	24332-661
R5	Carb 200Ω ±5% ¼W	24332-657
R6	Carb 4.7kΩ ±5% 1/10W	24331-300
R7	Carb 200Ω ±5% ¼W	24332-657
R8	Carb 1.8kΩ ±5% 1/10W	24331-286
R9	Carb 4.7kΩ ±5% 1/10W	24331-300
R10	Carb 47Ω ±5% ¼W	24332-637
R11	Carb 560Ω ±5% 1/10W	24331-272
R12	Carb 560Ω ±5% 1/10W	24331-272
R13	Carb 47Ω ±5% ¼W	24332-637
R14	Carb 12kΩ ±5% 1/10W	24331-312
R15	Carb 12kΩ ±5% 1/10W	24331-312
R16	Carb 1kΩ ±5% 1/10W	24331-280
R17	Carb 27kΩ ±5% 1/10W	24331-320
R18	Carb 27kΩ ±5% 1/10W	24331-320
R19	Carb 1kΩ ±5% 1/10W	24331-280
R20	Carb 680Ω ±5% 1/10W	24331-276
R21	Carb 1.8kΩ ±5% 1/10W	24331-286
R22	Carb 4.7kΩ ±5% 1/10W	24331-300
R23	Carb 22kΩ ±5% 1/10W	24331-318
R24	Carb 220Ω ±5% ¼W	24332-658
R25	Carb 200Ω ±5% ¼W	24332-657
R26	Carb 1kΩ ±5% 1/10W	24331-280
R27	Carb 2.7kΩ ±5% 1/10W	24331-292
R28	Carb 200Ω ±5% ¼W	24332-657
R29	Carb 4.7kΩ ±5% 1/10W	24331-300
R30	Carb 47Ω ±5% ¼W	24332-637
R31	Carb 560Ω ±5% 1/10W	24331-272
R32	Carb 560Ω ±5% 1/10W	24331-272
R33	Carb 47Ω ±5% ¼W	24332-637
R34	Carb 12kΩ ±5% 1/10W	24331-312
R35	Carb 12kΩ ±5% 1/10W	24331-312
R36	Carb 1kΩ ±5% 1/10W	24331-280
R37	Carb 22kΩ ±5% 1/10W	24331-318
R38	Carb 22kΩ ±5% 1/10W	24331-318
R39	Carb 1kΩ ±5% 1/10W	24331-280
R40	Carb 680Ω ±5% 1/10W	24331-276
R41	Carb 12kΩ ±5% 1/10W	24331-312
R42	Carb 2.2kΩ ±5% 1/10W	24331-288
R43	Carb 6.2kΩ ±5% 1/10W	24331-304
R44	Carb 1.8kΩ ±5% 1/10W	24331-286
R45	Carb 1kΩ ±5% 1/10W	24331-280
R46	Carb 4.7kΩ ±5% 1/10W	24331-300
R47	Carb 220Ω ±5% ¼W	24332-658
R48	Carb 200Ω ±5% ¼W	24332-657
R49	Carb 200Ω ±5% ¼W	24332-657
R50	Carb 4.7kΩ ±5% 1/10W	24331-300
R51	Carb 47Ω ±5% ¼W	24332-637
R52	Carb 560Ω ±5% 1/10W	24331-272
R53	Carb 560Ω ±5% 1/10W	24331-272
R54	Carb 47Ω ±5% ¼W	24332-637
R55	Carb 12kΩ ±5% 1/10W	24331-312
R56	Carb 12kΩ ±5% 1/10W	24331-312
R57	Carb 1kΩ ±5% 1/10W	24331-280
R58	Carb 22kΩ ±5% 1/10W	24331-318
R59	Carb 22kΩ ±5% 1/10W	24331-318

For symbols and abbreviations see introduction to this section

Circuit reference		Description	M.I. code
R60	Carb	1kΩ ±5% 1/10W	24331-280
R61	Carb	680Ω ±5% 1/10W	24331-276
R62	Carb	22kΩ ±5% 1/10W	24331-318
R63	Carb	4.7kΩ ±5% 1/10W	24331-300
R64	Carb	1kΩ ±5% 1/10W	24331-280
R65	Carb	1.8kΩ ±5% 1/10W	24331-286
R66	Carb	220Ω ±5% ¼W	24332-658
R67	Carb	200Ω ±5% ¼W	24332-657
R68	Carb	200Ω ±5% ¼W	24332-657
R69	Carb	2.7kΩ ±5% 1/10W	24331-292
R70	Carb	4.7kΩ ±5% 1/10W	24331-300
R71	Carb	47Ω ±5% ¼W	24332-637
R72	Carb	560Ω ±5% 1/10W	24331-272
R73	Carb	560Ω ±5% 1/10W	24331-272
R74	Carb	47Ω ±5% ¼W	24332-637
R75	Carb	12kΩ ±5% 1/10W	24331-312
R76	Carb	12kΩ ±5% 1/10W	24331-312
R77	Carb	1kΩ ±5% 1/10W	24331-280
R78	Carb	22kΩ ±5% 1/10W	24331-318
R79	Carb	22kΩ ±5% 1/10W	24331-318
R80	Carb	1kΩ ±5% 1/10W	24331-280
R81	Carb	680Ω ±5% 1/10W	24331-276
R82	Carb	22kΩ ±5% 1/10W	24331-318

TRANSISTORS

VT1	Ultra high speed - planar	MIP 95513
VT2	High speed epitaxial	MIP 95016
VT3	High speed epitaxial	MIP 95016
VT4	High speed epitaxial	MIP 95016
VT5	High speed epitaxial	MIP 95016
VT6	High speed epitaxial	MIP 95016
VT7	High speed - planar	MIP 95511
VT8	High speed epitaxial	MIP 95016
VT9	High speed epitaxial	MIP 95016
VT10	High speed epitaxial	MIP 95016
VT11	High speed epitaxial	MIP 95016
VT12	High speed epitaxial	MIP 95016
VT13	High speed epitaxial	MIP 95016
VT14	High speed epitaxial	MIP 95016
VT15	High speed epitaxial	MIP 95016
VT16	High speed epitaxial	MIP 95016
VT17	High speed epitaxial	MIP 95016
VT18	High speed epitaxial	MIP 95016
VT19	High speed epitaxial	MIP 95016
VT20	High speed - planar	MIP 95511
VT21	High speed epitaxial	MIP 95016
VT22	High speed epitaxial	MIP 95016
VT23	High speed epitaxial	MIP 95016
VT24	High speed epitasial	MIP 95016
VT25	High speed epitaxial	MIP 95016

10 Mc/s Multiplier and T.I.M. Gates: TM 7608

CAPACITORS

C1	Cer	300pF ±10% 500V	26383-211
C2	Cer	10pF ±5% 500V	26010-004
C3	Cer	560pF ±5% 200V	26010-026
C4	Cer	200pF ±5% 200V	26010-023
C5	Cer	75pF ±5% 500V	26010-014
C6	Cer	0.02μF +50% -25% 12V	26383-007
C7	Cer	0.02μF +50% -25% 12V	26383-007
C8	Cer	0.02μF +50% -25% 12V	26383-007
C9	Cer	0.02μF +50% -25% 12V	26383-007
C10	Cer	390pF ±10% 500V	26383-217
C11	Cer	0.1μF +80% -20% 10V	26382-214
C12	Cer	0.1μF +80% -20% 10V	26382-214
C13	Cer	300pF ±10% 500V	26383-211
C14	Cer	0.1μF +80% -20% 10V	26382-214
C15	Cer	0.1μF +80% -20% 10V	26382-214
C16	Cer	0.1μF +80% -20% 10V	26382-214
C17	Cer	150pF ±5% 500V	26010-020

For symbols and abbreviations see introduction to this section

Circuit reference	Description	M.I. code
C18	Cer 0.1μF +80% -20% 10V	26382-214
C19	Cer 0.1μF +80% -20% 10V	26382-214
INDUCTORS		
L3	6.8μH ±10%	23010-029
L4	82μH ±10%	23010-031
L5	82μH ±10%	23010-031
DIODES		
MR1	General purpose	MIP 91003
MR3	General purpose	MIP 91003
MR4	Silicon planar	MIP 91006
MR5	General purpose	MIP 91003
MR6	Silicon planar	MIP 91006
RESISTORS		
R1	Carb 390Ω ±5% ¼W	24332-065
R2	Carb 12kΩ ±5% 1/10W	24331-312
R3	Carb 1kΩ ±5% 1/10W	24331-280
R4	Carb 1kΩ ±5% 1/10W	24331-280
R5	Carb 430Ω ±5% 1/10W	24331-267
R6	Carb 2.7kΩ ±5% 1/10W	24331-292
R7	Carb 510Ω ±5% 1/10W	24331-270
R8	Carb 180Ω ±5% ¼W	24332-056
R9	Carb 2.7kΩ ±5% 1/10W	24331-292
R10	Carb 1kΩ ±5% 1/10W	24331-280
R12	Carb 2.2kΩ ±5% 1/10W	24331-288
R13	Carb 1kΩ ±5% 1/10W	24331-280
R14	Carb 6.8kΩ ±5% 1/10W	24331-306
R15	Carb 15kΩ ±5% 1/10W	24331-314
R16	Carb 270Ω ±5% ¼W	24332-061
R17	Carb 180Ω ±5% ¼W	24332-056
R18	Carb 12kΩ ±5% 1/10W	24331-312
R19	Carb 270Ω ±5% ¼W	24332-061
R20	Carb 2.2kΩ ±5% 1/10W	24331-288
R21	Carb 470Ω ±5% 1/10W	24331-269
R22	Carb 12kΩ ±5% 1/10W	24331-312
R23	Carb 3.3kΩ ±5% 1/10W	24331-294
TRANSFORMERS		
T1	R.F.	43567-004
T2	R.F.	43563-006
TRANSISTORS		
VT1	High speed - planar	MIP 95511
VT2	High speed - planar	MIP 95511
VT3	High speed - epitaxial	MIP 95010
VT4	High speed - epitaxial	MIP 95010
VT5	High speed - epitaxial	MIP 95010
VT6	High speed - epitaxial	MIP 95010
VT7	High speed - epitaxial	MIP 95010
VT8	High speed - epitaxial	MIP 95010

For symbols and abbreviations see introduction to this section

Section 7

Circuit diagrams

Circuit notes

1. COMPONENT VALUES

Resistors: No suffix = ohms, k = kilohms, M = megohms.
Capacitors: No suffix = microfarads, p = picofarads.
* Value selected during test; nominal value shown.

2. SYMBOLS

indicates clockwise rotation of knob

indicates pins or sockets to front of unit

indicates pins or sockets to rear of unit

indicates stake pins

Numbers adjacent to transistors and diodes refer to MIP specifications.

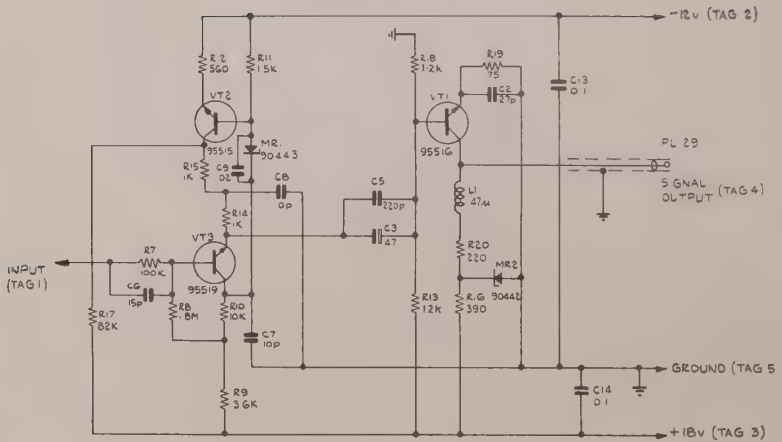


Fig. 7.1 Impedance Buffer TM 7646

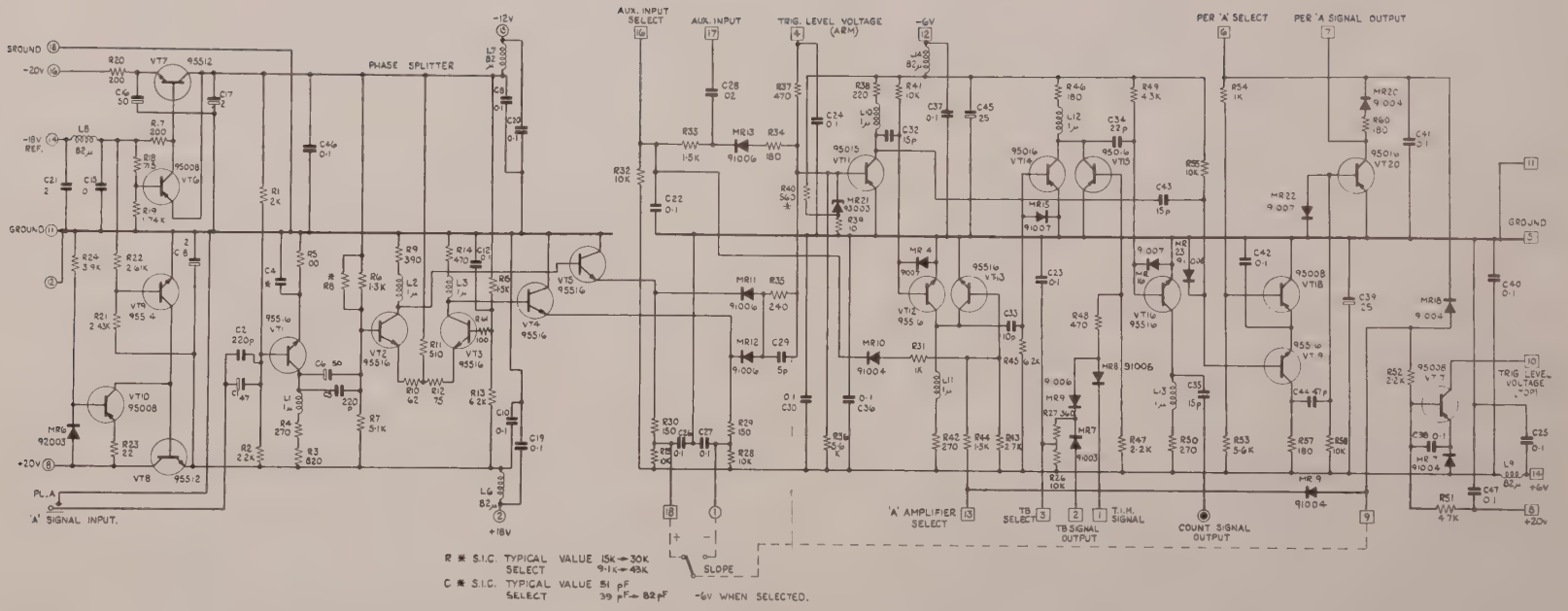
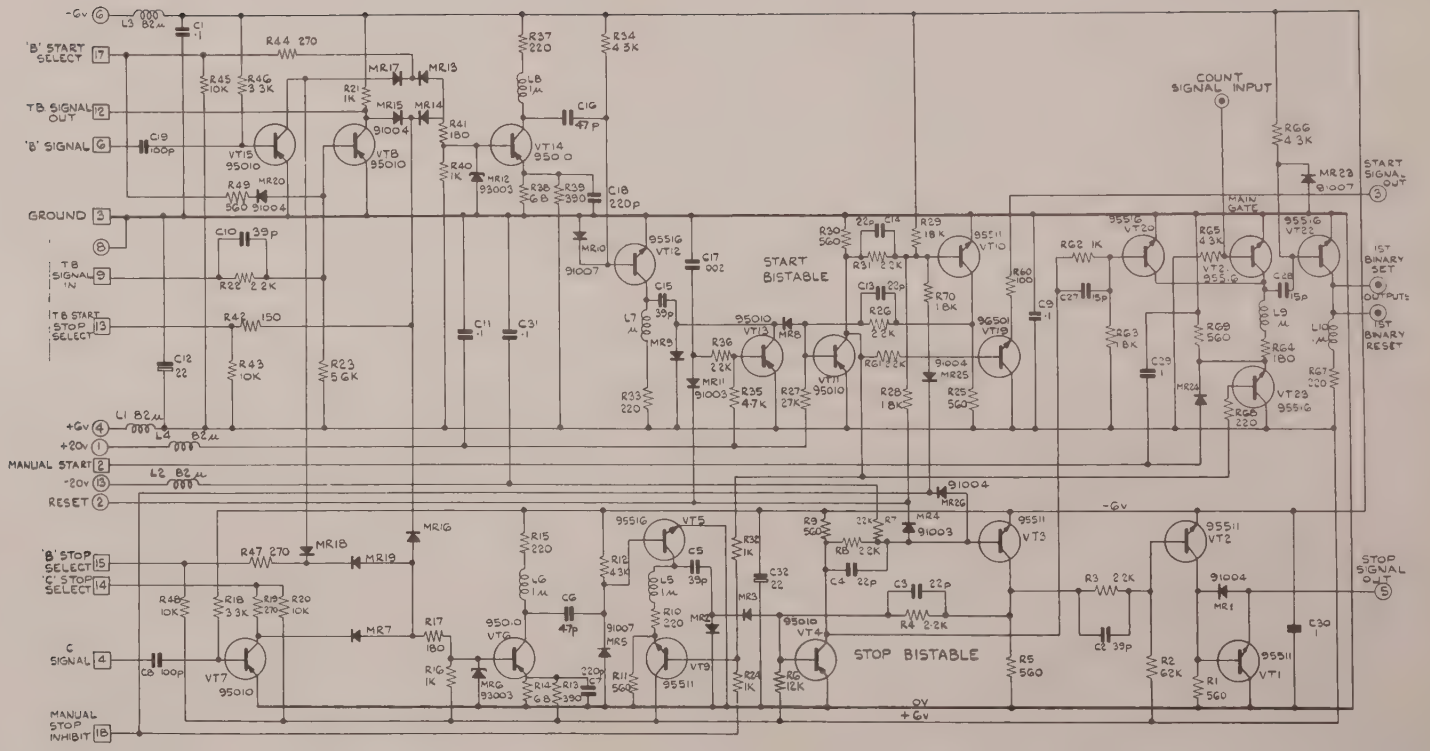
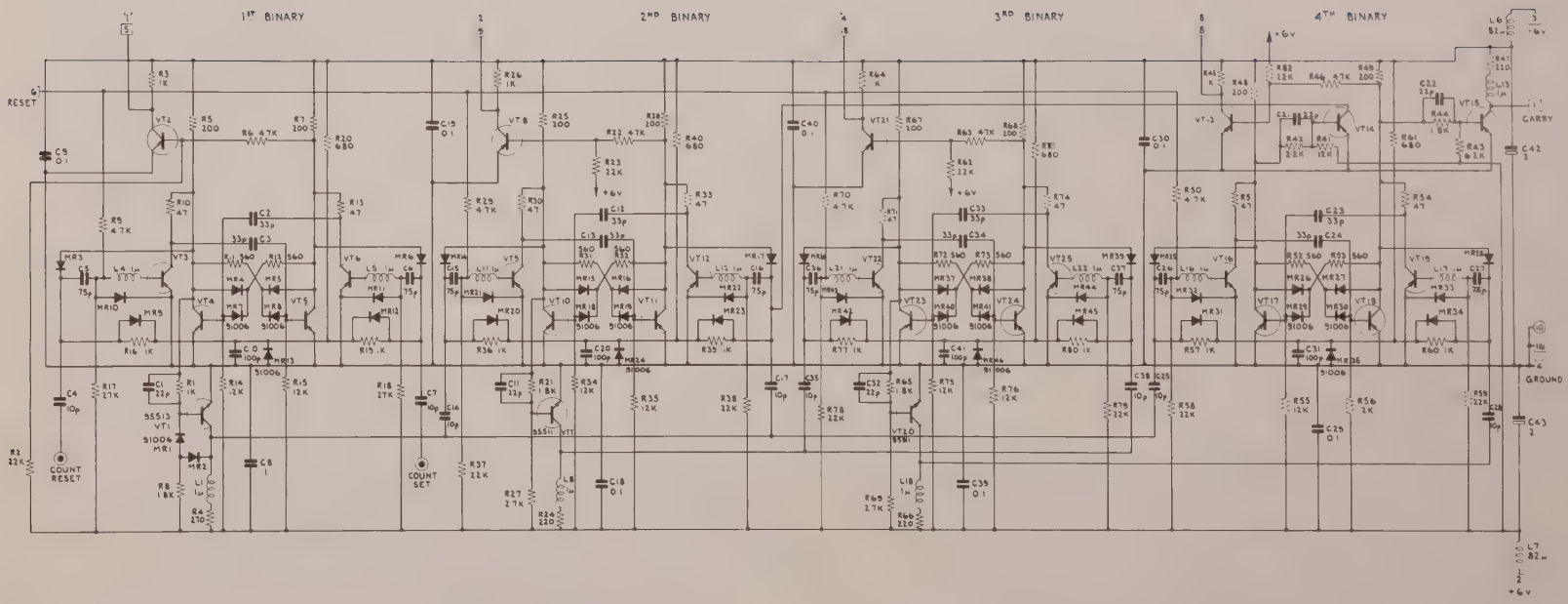


Fig. 7.2 50 Mc/s Input Amplifier TM 7607



All diodes are to MIP 91006 unless shown otherwise

Fig. 7.3 Gate Control and Count Gate TM 7605



All transistors are to MIP 95016 unless shown otherwise

All diodes are to MIP 91007 unless shown otherwise

Fig. 7.4 50 Mc/s D.C.U. TM 7606

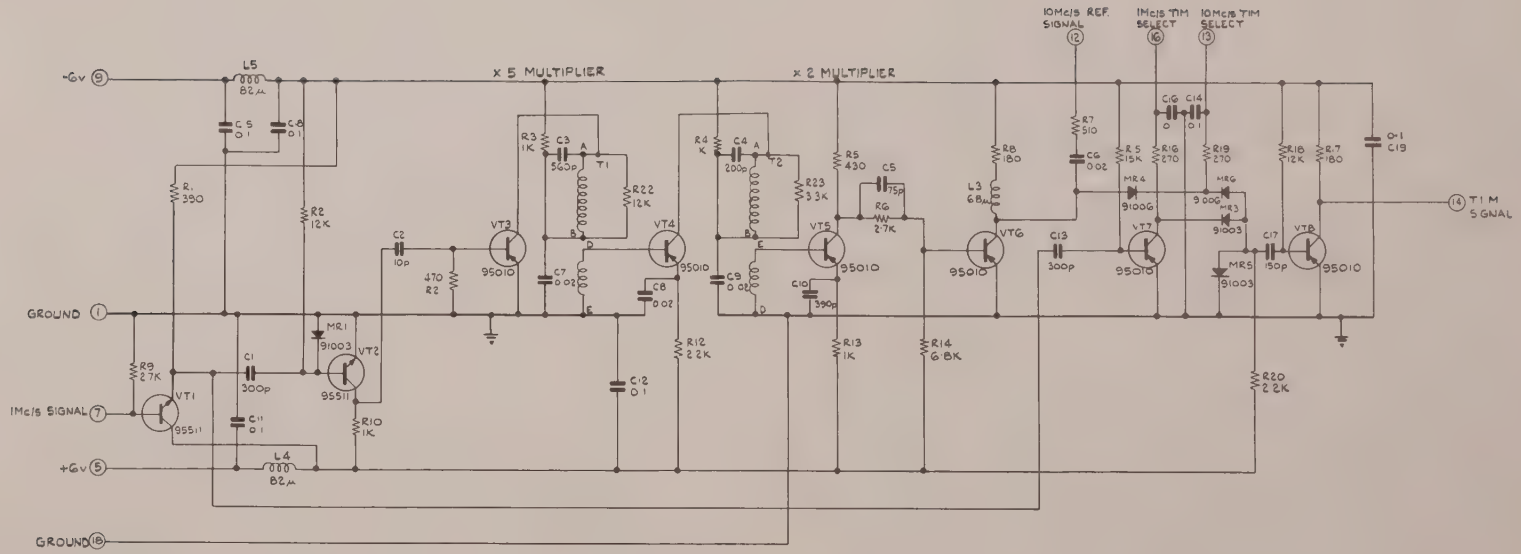


Fig. 7.5 10 Mc/s Multiplier TM 7608

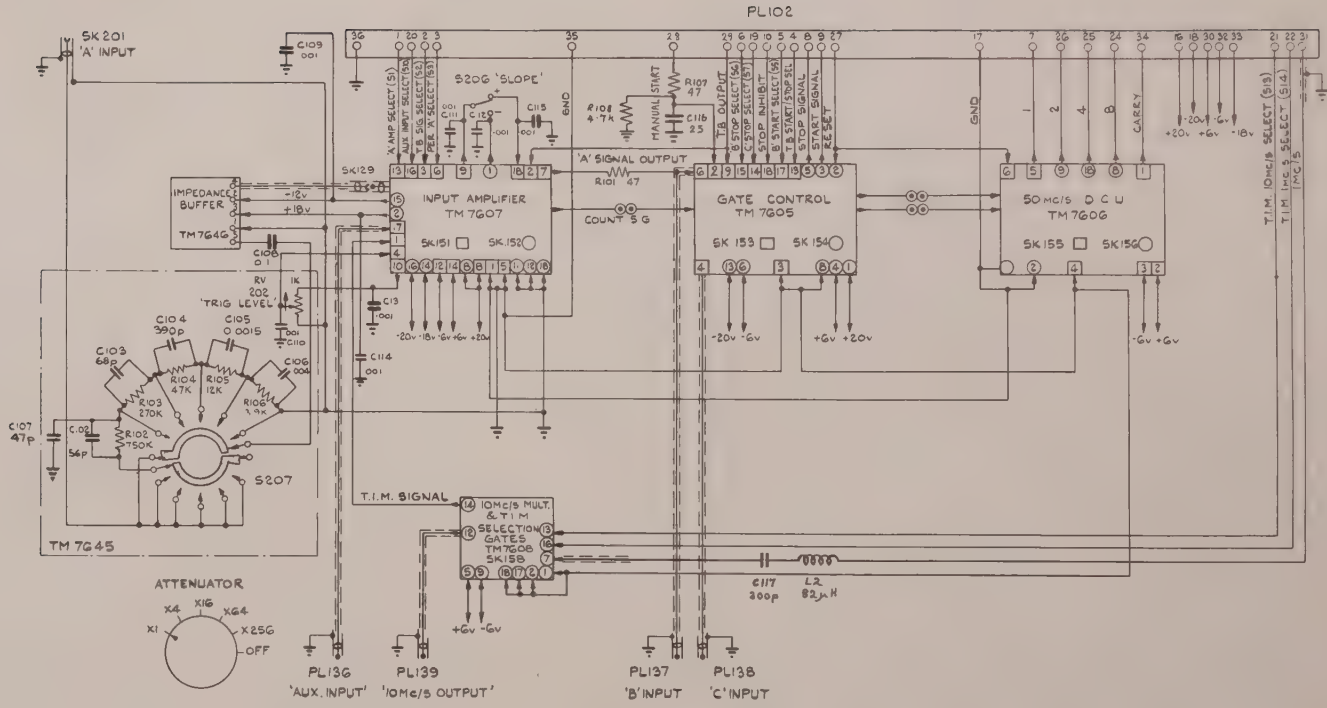


Fig. 7.6 Interconnecting diagram

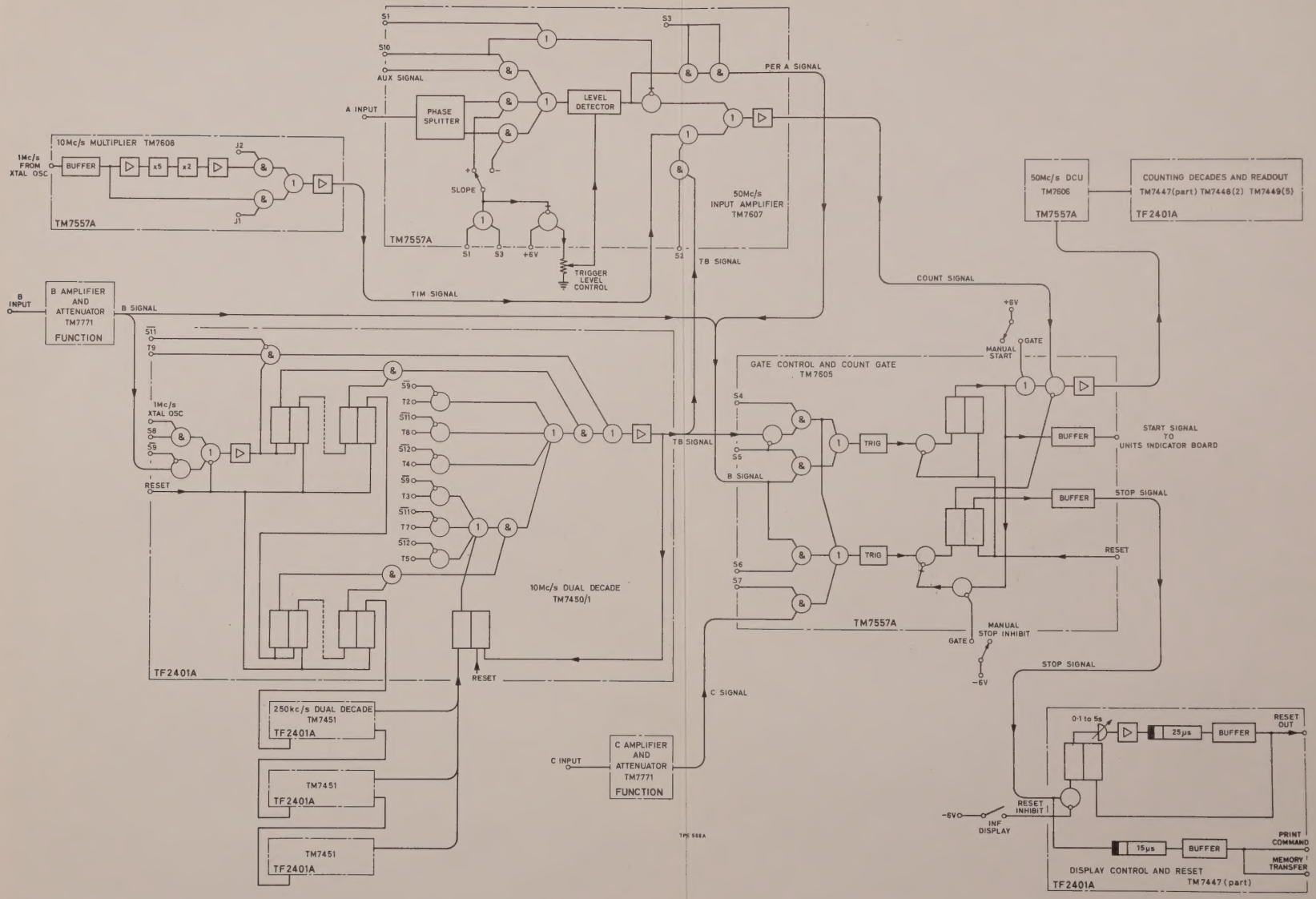


Fig. 7.7 Logic diagram

TM 7557A

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WORLD-WIDE REPRESENTATION

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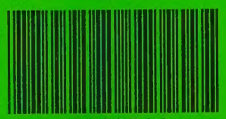

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